the I.P. Sharp newsletter

NOVEMBER-DECEMBER 1976
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The Sharp communications network has expanded to include forty-seven cities. A satellite link is in operation between Dallas and Rochester, New York.

* Amsterdam Ann Arbor Atlanta Boston Brussels Buffalo Calgary Chicago Cleveland Coventry Dallas Des Moines Düsseldorf Edmonton Frederickton Fort Lauderdale Gloucester Halifax Hamilton Kingston Kitchener London England London Ontario Los Angeles Miami Milan Minneapolis Montreal Newport Beach New York Ottawa Paris Quebec Raleigh Rochester San Francisco Saskatoon Seattle Stamford Syracuse Toronto Vancouver Victoria Washington White Plains Winnipeg Zürich

MAGIC WITH THE AVIATION DATA BASES

This is a new manual written specifically for users of Aviation Data.

The Aviation Data Base is one of the on-line data bases available to all users of the Sharp APL system. By use of a suitable computer terminal, direct access to this data base using English like commands is available in 47 major North American and European centres. The data base is constructed of CAB reports submitted to the Civil Aeronautics Board in Washington D.C. by all U.S. commercial air carriers, and from other official sources. The data is comprised of balance sheet, expense, revenue and traffic statistics by aircraft type, type of service and by airport for over 60 carrier entities. Also included are the detailed itineraries of a 10% survey of all passenger tickets in the U.S. Domestic market. In all, there are about one million timeseries associated with the data base. Other data bases which can be usefully linked with the Aviation Data Base include the National Bureau of Economic Research (NBER) data base, containing 2400 timeseries relating to the U.S. economy, and the International Monetary Fund (Financial Statistics) data base containing over 20,000 economic timeseries for most countries of the world.

Access to all of the Aviation Data Base is possible with the English oriented system called MAGIC. MAGIC is a general system which specifically addresses the problems associated with the analysis of timeseries data. A full description of the operation of the MAGIC system may be found in the Sharp manual "MAGIC for Timeseries Analysis". Several additions to the MAGIC system have been made for access to the Aviation Data Base that specifically address the nature of this data, and they are discussed in "MAGIC with the Aviation Data Bases". Due to the size of the data base, a specialized set of cross-referencing facilities have also been tailor-made.

Despite the seeming complexity of the system and the data base, it requires surprisingly little time for non-computer oriented analysts to make successful use of the system. The ratio of time required to analyze data using a manual filing system versus the MAGIC approach is often 15 to 1. And of course, once programs are established, they may be easily rerun to analyze the latest data as it becomes available with little time involved. Even light or casual use of the system is possible and cost-effective, since there is no royalty or surcharge for use of the data.

Please contact your local Sharp APL representative if you would like a copy of this manual, and for any additional information.

NEW SHARP APL DOCUMENTATION

The first of a series of small, user-oriented application manuals, the Sharp APL Application Briefs, are now available. The briefs focus on the information a user might need to get started using either a library package or a public data base.

They generally contain a description of the scope of the package, and of appropriate methods for accessing the software. A sample terminal session and references to related documentation are usually included.

Current titles:

IFS	- International Monetary Fund, Financial Statistics database
MBANKS	- Canadian Chartered Banks Database, Monthly
QBANKS	- Canadian Chartered Banks Database, Quarterly
CANSIM	- MINIBASE: Canadian Socio-economic database
OECD	- Organization for Economic Cooperation & Development database
CROSSTAB	- Cross-tabulation.

These briefs are not a replacement for the longer, more formal manuals, nor for the Sharp APL Technical Notes (SATNs). They are seldom longer than 10 pages and are priced at 50¢ each.

SHARP APL TECHNICAL NOTES - *SATN INDEX*

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A current copy of the index will be published in all subsequent newsletters.

Sharp APL Library

The Sharp APL Applications Software Library consists of more than 200 workspaces. These may be systems for common applications, utility functions that can be incorporated into user systems, or functions that can be collected to solve a specific problem. Judicious use of the library will eliminate duplication of effort and expand your problem-solving capability.

The library workspaces are organized into multiple workspace systems or into related groups of single workspaces. They are numbered as follows:

Library Numbers	Classification
1-9	General
10-19	APL education
20-29	Mathematics
30-39	Statistical Analysis
40-49	Operations Research
50-59	Finance
60-69	Engineering
70-79	Miscellaneous systems
80-89	Socio-economic data bases
90-99	Fun and games

The libraries are continually updated, either by the addition of new workspaces or by the incorporation of changes into existing workspaces. Obsolete workspaces will remain available in library 499 - the old library number is appended to the end of the name, for instance, 3 *PLOTPAK* has become 499 *PLOTPAK*3.

The Sharp APL library cataloque provides an index to all public workspaces and a set of cross-references, so that the libraries may be searched by workspace name, by area of application, and by location. The *DESCRIBE* in the workspaces contains more details, and some 20 manuals are available for specific packages. On-line documentation and cross-referencing functions for the libraries will be available shortly. Please contact your local Sharp representative, or the system librarian (*SYSL*) for further information.

NEW LIBRARY WORKSPACES

Sharp APL Graphics

3 *GRAPHICS*
3 *GRAFIX*
3 *DEMOONLY*

These workspaces contain about 150 functions for use as building blocks in the construction of graphics applications in Sharp APL. A wide range of terminals is supported. Only one terminal-dependent function, different versions of which are specific to different terminals, has been included. (See pages 6 & 7.)

(continued)

NEW LIBRARY WORKSPACES (continued)

5 *TRENDATA* A new workspace that demonstrates the capabilities of the Trendata 4000 terminal.

Cross-tabulation Package

31 *CROSSTAB* A new cross-tabulation system that incorporates several important improvements over previous cross-tabulation offerings:

- Sample sizes of up to 30,000 are now permitted
- Unlimited number of search levels
- Easy-to-use query language
- Attractive, presentable reports
- Comprehensive data base editing capabiliites
- Added input flexibility.

Raw data can be retrieved, allowing the user to perform statistical analysis as needed. On-line documentation is in *DESCRIBE*, and a new Sharp APL Application Brief "Cross-tabulation" is available. Please contact your local Sharp representative, or Steve Levy (*SWL*) in Newport Beach, for additional information.

Canadian Chartered Banks Database, Monthly

54 *MBANKS* This workspace replaces 54 *BANKS*. The most important change is that the new version has provision for a variable number of banks and facts, whereas the old version treated these quantities as constants. The new version will therefore provide complete information if either quantity in the database increased. The new *MBANKS* Database now contains data for another Chartered Bank (Canadian Commercial and Industrial Bank). Please use the new functions - the changeover is simple since the user interface is almost unchanged. Details are in the Brief "Chartered Banks Database, Monthly".

51 *OPTFILE* This new workspace contains small functions to retrieve the stock option functions from file and erase them immediately after execution. Use as a last resort in cases where incorporation of the full function code would lead to *WSFULL*.

CHANGES TO EXISTING WORKSPACES

7 *WSDOC* Workspace documentation is now considerably less expensive since cross-referencing of function and variable names has been speeded up by a factor of about two.

23 *STP4*
23 *STP6* Linear programming workspaces. Users who have incorporated the function *RSIM* into systems of their own should replace it with the new version that now finds a solution in all cases.

(continued)

CHANGES TO LIBRARY WORKSPACES (continued)

32 *PDLAG*	Shiller lag analysis is now available.
41 *MINIPERT*	The calendar has been extended to 1984 (really).
51 *STOCKOPTION*	Two functions, *OPES* and *OPNUM*, have been added and the function *OPUND* is now dyadic. Details are in *DESCRIBE*.
54 *QBANKS*	The function *QBAVAIL* has been added - details are in *DESCRIBE* and in the Application Brief "Chartered Banks Database, Quarterly".
88 *GOFER*	The Gas and Oil Field Evaluation System can now be run as a batch APL task (*BTASK*) after user input is accomplished. There are three new functions: a new report generator *NORMAL*; *PURGE* allows cases to be dropped after a given date; and *EXPDECLINE* models production using exponential decline. The function *QUICK* now generates profitability index and payout after tax.

OBSOLETE WORKSPACES

These workspaces will remain for some time in library 499. The name has been changed to incorporate the old library number, as follows:

Old Library	Currently WS	Superceded By
3 *TSPLOT*	499 *TSPLOT3*	3 *PLOT*, 3 *GRAPHICS*, 3 *GRAFIX*, 3 *DEMOONLY*
3 *PLOTPAK*	499 *PLOTPAK3*	3 *PLOT*, 3 *GRAPHICS*, 3 *GRAFIX*, 3 *DEMOONLY*
4 *EDITPAK*	499 *EDITPAK4*	4 *EDIT*
32 *MARQUARDT*	499 *MARQUARDT32*	32 *NONLINEAR*
32 *STAGE2*	499 *STAGE232*	32 *REGRESSION* (Two-stage least squares).

SHARP APL *Graphics*

The Sharp APL Graphics package has now been released. There are about 150 functions (in library 3) that can be used to construct interactive and non-interactive graphics applications in Sharp APL.

Graphic objects are represented and manipulated in familiar APL ways; sets of points (with or without connecting lines) are treated conceptually the way APL treats scalar values. There are many functions that mimic the actions of APL primitives - on sets of points or collections of sets - for example, combining them into graphic vectors that are subject to concatenation, compression, and so on. These objects may also be stored on files.

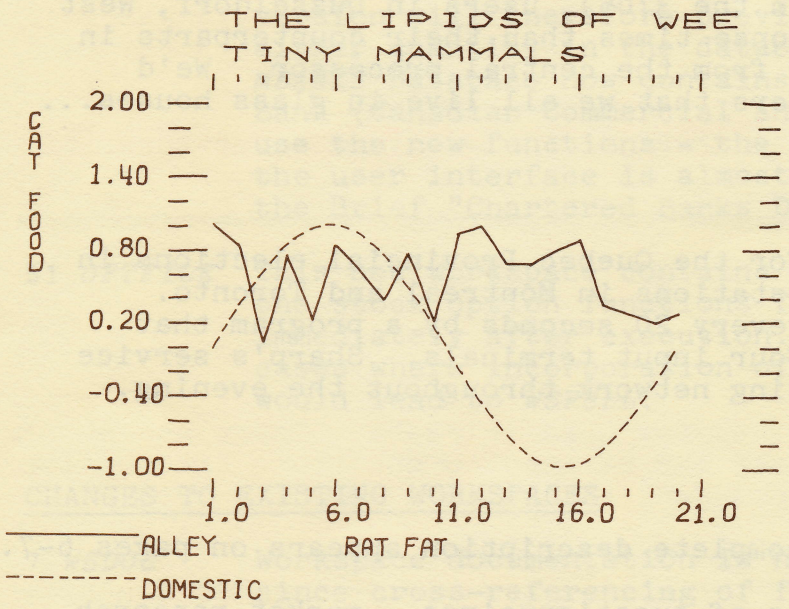
(continued)

SHARP APL GRAPHICS (continued)

The routines in the library are deliberately general in order to get a new system running quickly. Modifications to the system can therefore be made at the outset, and once the code has become fairly stable it can be specialized for more favourable running costs. This approach to fine tuning is more disciplined and more efficient.

There is only one terminal-dependent function which can be easily modified to drive a variety of terminals. The DTC300 and 302, the TEK4013 and 4015, DIABLO 1550 and 1620, AJ832, Trendata 4000 and the Houston Instruments Plotter, are presently supported. The system will also support TEK4013 and 4015 crosshair input, and input from a TEK4953 Graphics tablet. The set of supplied routines for input/output device support will grow with time, but user-written routines can generally be integrated into the system without difficulty. Please note that the superplot or ultraplot feature must be present on those terminals that have that option, for the Sharp APL routines to work properly. Use of these terminals without superplot more than doubles the cost of producing graphics output, therefore it is probably wise to invest in the superplot feature. The user is, of course, free to support non-superplot terminals on his own.

Workspace 3 *GRAPHICS* contains all the functions in a readable form, with comments. 3 *GRAFIX* contains the same functions stripped of comments and diamondized to save space.



3 *DEMOONLY* provides access to the terminal-dependent input/output routines, and some demonstrations of the capabilities of the graphics system.

At left is a sample plot produced by the system on the Houston Instruments Plotter.

Please contact your local Sharp representative for more information on this system.

LOCAL DIAL-UP ACCESS

Two more points have been added to the Sharp network: Zürich, Switzerland, and Victoria, B.C., the most westerly point of the network in Canada. The number of cities with local access to the Sharp system now numbers 47 - count them on page 1.

ZÜRICH Autospeed - (01) 39 98 90
VICTORIA 30 cps - (604)382-1800

MIKE RIEDEL is now at the Zürich office, and STEVE KOHALMI is in Düsseldorf, both recently from Toronto. They will be happy to provide any assistance necessary to users in and around those cities.

JOHN CARPENTER is the branch manager responsible for both the Dallas office and the new office in Houston, Texas. The telephone number for the latter has been changed to:

(713)526-5275

MIKE SYMES has joined the Special Projects group in Toronto, after teaching computer science at Queen's University (Kingston, Ontario) for four years.

RESPONSE TIME

Due to a technical anomaly (in the 3705), users in Düsseldorf, West Germany, have had better response times than their counterparts in Toronto, a stone's throw away from the central processor. We'd like to remind our Toronto users that we all live in glass houses...

ELECTION RESULTS

Sharp processed the results for the Quebec Provincial elections in November, for two television stations in Montreal and Toronto. Party standings were updated every 20 seconds by a program that picked up transactions from four input terminals. Sharp's service was ahead of the major competing network throughout the evening.

NEW APPLICATION PACKAGES

GRAPHICS have gone public - complete description appears on pages 6-7.

CROSS-TABULATION: the analyses of questionnaires, market research data and opinion polls can all benefit from this new Sharp APL system described on page 5.

NEW STATISTICAL MANUAL - "Box-Jenkins" is now available from Sharp. A description of the package appears on page 8 of the Sep/Oct 76 issue.

PACKAGES

In the next newsletter we will be telling you about a brand new feature of Sharp APL which will be known as *PACKAGES*. Just so that you can start thinking about it and how you might use it, we are announcing it here, and then, when the *SATN* appears in January you will know what we are talking about. The *SATN* will be announced through the *HI* messages that you receive when you sign on.

A *PACKAGE* is a collection of APL entities which may be functions and variables (of different data types) assembled together and treated as a single entity.

A *PACKAGE* may be written away as a file component and of course read back as a file component. It may be erased using the system command)*ERASE*, and may be selectively broken down, or indeed create *PACKAGES* from several other *PACKAGES*.

The main object of the exercise is to provide a sanitary and simple mechanism for coping with the overlay structures needed in large APL systems, but without the necessity to convert functions to character strings.

Sharp Special Systems

CHOOSING THE RIGHT MINI

by Hugh O'Rourke

If attention, favourable or otherwise, is any indication of popularity, minicomputers certainly are. Most computer trade magazines and newspapers have special minicomputer sections now, and articles on the subject abound. These seem to fall into two broad categories; those that brag about how much money this or that firm has saved by installing a minicomputer (often by the ritualistic burial of their senile mainframe), and those that start off something like "The trouble with minis ... "

I think both types of articles are somewhat extremist. But at the moment I'd like to discuss the second, those that talk about the "tragic flaw" in minicomputers - rather like a high-school English teacher explaining why Shakespeare heroes are doomed in the long run, and invariably end up dead, or worse.

There really is nothing wrong with minicomputers per se. They are, after all, just hardware - like automobiles or dishwashers. Assuming they are fit (no flat tires or blown transistors), they will do the job for which they were designed. But herein, as Willie once wrote, lies the rub, for the trouble with minis lies mainly in choosing the right one.

CHOOSING THE RIGHT MINI (continued)

And no wonder. Computer shows these days make me think of department store Toylands at Christmas; something for everyone, in whatever size, colour, shape or price-range you want (batteries not included). I'm certainly in favour of free enterprise and lots of competition, but while a wide selection means that you should be able to find hardware exactly appropriate to your needs, much time can be spent weeding out the ones you shouldn't buy.

Ironically, often one of the biggest stumbling-blocks to discovering which mini has the required designed-in capacity is the manufacturer's salesman. There are exceptions, but the tendency is to claim their processor or system is the best of all possible solutions, whatever the application. All too often, instead of providing technical information, customers or application are approached as public relations exercises. Too much emphasis is placed on finding out how many dollars for hardware are in the budget and not enough on the requirements of the application.

I think part of the problem here is lack of training, and perhaps understandably so. The fantastic growth of the minicomputer industry is often blamed for poor quality of service - the demand just far outstrips the supply of qualified people. The same is true of the sales area, and the phrase "I don't know, but I'll get back to you... " is heard all too frequently.

Aside from the disturbing technical shallowness, I am suspicious that the salesman will get together with the boys in the back room, not to decide "yes" or "no", but to find some way of answering the question that will keep the customer happy without flagrantly misrepresenting the product.

Vendor literature is not much help either. Marketing "glossies" or brochures are mostly eye-catching arrangements of touched-up photographs and industry-compatible buzz-words. User manuals should be the ultimate source of information, but seldom are. The quality varies greatly from one company to another, but they are often poorly organized, and occasionally contain outright misrepresentations. But as the salesman is often not a source of data, the prospective buyer must resort to user's manuals. This can be a monumental task, particularly to evaluate more than one product. The hardware and software manuals associated with one relatively small system we installed recently, took up twenty-eight inches of shelf space.

Which brings me to another point, software. Most of the programming languages developed on the larger mainframes are now available on minis. The catch here is that the quality of the implementation varies widely from mini to mini. I recently did a study for a local government agency, part of which involved an evaluation of the various implementations of BASIC. The intended application was fairly routine, and so the required features were not out of the

ordinary. BASIC is widely available on minis, but the field was quickly narrowed to a half-dozen, and after detailed investigation, only two appeared adequate.

This is not to say that the other BASICs are useless. The deficiencies of a given language implementation can always be circumvented, but this escalates programming costs, and over the life of most systems more money will be spent on software than on hardware and maintenance.

And so, finally, to price. One reason for the popularity of minis is their relatively low purchase price, but this is only part of the total cost of the system. The danger in buying inexpensive hardware is that it will likely prove relatively expensive to program and maintain.

It is particularly important not to skimp on the processor. On the average, from 60 to 80% of the cost of a system will be for peripherals, and the prices for these are fairly standard. If you need say, 10 CRT terminals and 100 megabytes of disc storage, a vendor usually can't do much about the price in this area. If, however, he thinks price is a big issue with you, one way he can lower the total price is by suggesting a smaller processor and/or less memory.

Memory is pretty cheap these days, so there's no excuse for not buying a lot, particularly if you're going to have on-line terminals. Too little necessitates a lot of swapping and/or overlaying, both of which waste disc-transfer time. Discs are relatively slow devices, and an inquiry from an on-line terminal usually results in several disc accesses to locate a particular record. If, in addition, the program and/or terminal buffers are continually being transferred back and forth between disc and memory, the system quickly becomes "disc-bound", resulting in poor response-times and support for an unreasonably low number of on-line terminals. Good response times are not necessarily crucial for enquiry, but they are for on-line data entry. On one system, response time with two terminals operating was fifteen seconds. The addition of an extra 16K of memory (which, unfortunately in this case, necessitated in upgrading the processor to one which could accomodate more than 32K words of memory), dropped response time to just under one second.

This is a rather dramatic illustration of the impact hardware selection can have on system performance. And although I don't want to give the impression that choosing a mini is an impossible task, on the other hand, perhaps because of the relatively low cost of minicomputer hardware, it is one which is often not taken seriously enough.

SHARP APL COURSE SCHEDULE

Introductory courses:	JANUARY	FEBRUARY	MARCH
LONDON, ENGLAND		☐ 16-18,21,22	☐ 23-25,28,29
LONDON, ONTARIO		☐ 23-25	
LOS ANGELES	☐ 3-7	☐ 7-11	☐ 7-11
MINNEAPOLIS	☐ 8-11		
OTTAWA	☐ 3-7	☐ 7-11	☐ 7-11
ROCHESTER	☐ 17-21	☐ 21-25	☐ 21-25
TORONTO	☐ 3-6	☐ 14-17	
TORONTO	☐ 17-20	☐ 28-2 March	
TORONTO	☐ 31-3 Feb		
VANCOUVER	☐ 10-12		
Intermediate APL:			
MINNEAPOLIS			☐ 2-4
TORONTO	☐ 10-12	☐ 7-9	
TORONTO	☐ 24-26	☐ 21-23	
Advanced APL:			
LONDON, ENGLAND		☐ 7-8	
MINNEAPOLIS	☐ 19-21 ("Financial Planning in APL")		
TORONTO	☐ 21	☐ 18 ("NTASKS and BTASKS")	

☐ Please amend my mailing address as indicated.

☐ Add to your mailing list the following name(s).

☐ Send me a SHARP APL publications order form.

☐ Please register me for the APL course as marked.

☐ Note my comments: _____

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Technical Supplement - 8

FILE UPDATING AND RESTARTABILITY

WORKSPACES AND FILES IN APL WORK ASYNCHRONOUSLY. WHICH CAN CAUSE THE TWO TO BE OUT OF STEP AS A RESULT OF A SYSTEM CRASH.

FOR EXAMPLE. A FUNCTION COULD BE WRITING INFORMATION TO A FILE UP TO THE MOMENT OF A CRASH: BUT THE COPY OF THE WORKSPACE RECOVERED FROM SECONDARY STORAGE COULD BE AT MOST 4 SECONDS OUT OF DATE.

THUS WHEN DESIGNING UPDATING SYSTEMS, IT IS IMPERATIVE TO CONSIDER THE POSSIBILITY OF HAVING FILES AHEAD OF THE FUNCTION, AND TO PERMIT INCORPORATION OF THE NECESSARY CORRECTIVE STEPS INTO THE USER-RESTART ROUTINES.

UPDATING SYSTEMS CAN BE SEPARATED INTO FIVE GENERAL CLASSES:

1) SIMPLE SEQUENTIAL
2) SIMPLE RANDOM
3) COMPLEX SEQUENTIAL
4) COMPLEX RANDOM
5) COMPOSITE

IN THIS ISSUE WE WILL DISCUSS THE TWO MOST POPULAR UPDATING PROCEDURES - THE 'SIMPLE' UPDATES, SEQUENTIAL AND RANDOM. WE WILL ALSO PRESENT GENERALIZED APL REPRESENTATIONS OF SUCH SYSTEMS, AND USE THEM AS BASES TO DISCUSS THE MORE COMPLICATED PROBLEM OF 'COMPLEX' UPDATES IN FUTURE SUPPLEMENTS.

A SIMPLE SEQUENTIAL PROCESS IS UPDATED BY MEANS OF ⎕APPEND. THE FILE TO BE MODIFIED IS INITIALLY EMPTY AND IS BUILT UP IN SEQUENTIAL STEPS. THE PROCESS IS 'SIMPLE' IF THE INFORMATION PRODUCED FOR EACH COMPONENT CAN BE DERIVED BY ONLY KNOWING THE COMPONENT NUMBER.

THE APL REPRESENTATION IS AS FOLLOWS:

```
    ∇ UPDATESS;I;LIM;OUTFILE
.
[ ]   I←1
[ ]  L1:(PROCESS I) ⎕APPEND OUTFILE
[ ]   →(LIM≥I←I+1)↑L1
```

'I' IS A MONOTONICALLY INCREASING COUNTER RUNNING TO THE UPPER LIMIT OF PROCESSING STEPS 'LIM'.

'PROCESS' REPRESENTS A 'SIMPLE' COMPUTATION WHICH IS A FUNCTION OF I: EACH EXECUTION OF PROCESS I FOR THE SAME I GIVES THE SAME RESULT.

A SYSTEM CRASH COULD CAUSE THE COUNTER IN THE WORKSPACE TO LAG THE FILE COMPONENTS FOR REASONS DISCUSSED EARLIER. WE WOULD LIKE TO DEVISE A MECHANISM SO THAT, UPON BRANCHING TO A LOCAL RESTART POINT (SAY 'GOON') WE RESET THE NECESSARY COUNTERS.

THE 'RESTARTABLE' FUNCTION WOULD THEN LOOK LIKE THIS:

```
    ∇ UPDATESS;I;LIM;OUTFILE
.
[ ]   I←1
[ ]  L1:(PROCESS I)⎕APPEND OUTFILE
[ ]  L2:→(LIM≥I←I+1)↑L1
.
.
[ ]  GOON:I←(⎕SIZE OUTFILE)[2]-1  ◇ →L2
```

AFTER RESTART, →GOON WOULD RESET THE COUNTER 'I' TO THE LAST COMPLETED PROCESS FOUND IN THE FILE. BRANCHING TO L2 WOULD THEN RESUME THE OPERATION FROM THAT POINT.

THE GENERALIZED SIMPLE SEQUENTIAL PROCESS CAN BE REPRESENTED AS HAVING A FIXED (≥1) NUMBER OF ⎕APPEND'S FOR EACH PROCESSING STEP I. THE CORRESPONDING APL FUNCTION, WITH THE RESTART LINE. WOULD LOOK AS FOLLOWS:

```
    ∇ UPDATEGSS;I;J;N;OUTFILE
.
[ ]   I←J←1
[ ]  L1:(I PROCESS J) ⎕APPEND OUTFILE
[ ]  L2:→(N≥J←J+1)↑L1
[ ]   J←1 ◇ →(LIM≥I←I+1)↑L1
.
[ ]  GOON:J←1+N|I←(⎕SIZE OUTFILE)[2]-1 ◇ I←1+⌊I÷N ◇ →L2
```

THE 'PROCESS' FOR EACH I CAN NOW BE VISUALIZED AS CONSISTING OF N SUB-PROCESSES RESULTING IN A TOTAL OF N×LIM ⎕APPEND'S.

SIMPLE RANDOM UPDATES CONSIST OF ⎕REPLACE PROCESSES, WHICH CAN BE CHARACTERIZED AS FOLLOWS:

```
    ∇ UPDATESR;I;LIM;OUTFILE
[ ]   I←1
[ ]  L1:(PROCESS I) ⎕REPLACE OUTFILE, COMP I
[ ]   →(LIM≥I←I+1)↑L1
```

'I' IS A MONOTONICALLY INCREASING COUNTER RUNNING TO THE UPPER LIMIT OF PROCESSING STEPS 'LIM'.

UNLIKE ⎕APPEND, WE HAVE TO SPECIFY AN OUTPUT LOCATION FOR EACH STEP. THIS IS DONE THROUGH THE FUNCTION 'COMP'.

FOR THE PROCESS TO BE 'SIMPLE' WE FURTHER REQUIRE 'COMP' AND 'PROCESS' TO BE FUNCTIONS OF I. EACH EXECUTION OF 'COMP I' AND 'PROCESS I' FOR THE SAME I MUST GIVE THE SAME RESULTS, RESPECTIVELY.

UPON RESTART, WE CANNOT SIMPLY LOOK AT THE END OF THE OUTPUT FILE TO RESET THE COUNTERS. INSTEAD, IN ORDER TO AVOID REPEATING ⎕REPLACES FROM THE POINT OF INTERRUPTION, WE CAN START AT THE CURRENT WORKSPACE LOCATION AND MOVE STEP-BY-STEP UNTIL WE GET A NON-INCREASING ⎕RDCI IN THE OUTPUT FILE. THIS WILL INDICATE AN INTERRUPTION IN OUR SEQUENCE OF UPDATES.

REPRESENTING THE PROGRAM IN APL, WE GET THE FOLLOWING:

```
    ∇ UPDATESR;I;LIM;OUTFILE;T1;T2
[ ]   I←1
[ ]  L1:(PROCESS I) ⎕REPLACE OUTFILE, COMP I
[ ]  L2:→(LIM≥I←I+1)↑L1
[ ]  L3:
[ ]  GOON: →(I∈1,LIM)↑L1 ⍝ I=1: NO TIMESTAMP FOR TESTING IS GUARANTEED
[ ]    ⍝ I=LIM: THERE IS NO SUCCESSOR TO THE LAST ITERATION.
[ ]   T1←(⎕RDCI OUTFILE, COMP I)[3]
[ ]  L99:→(LIM<I←I+1)↑L3
[ ]   T2←(⎕RDCI OUTFILE, COMP I)[3]
[ ]   →(T2<T1)↑L1 ◇ T1←T2 ◇ →L99
```

ALL OF THE ABOVE EXAMPLES ASSUME THAT
(1) NO FILE COMPONENTS WERE DAMAGED,
(2) 1 ORIGIN WAS USED, AND
(3) THE OUTPUT FILE WAS EXCLUSIVELY TIED.

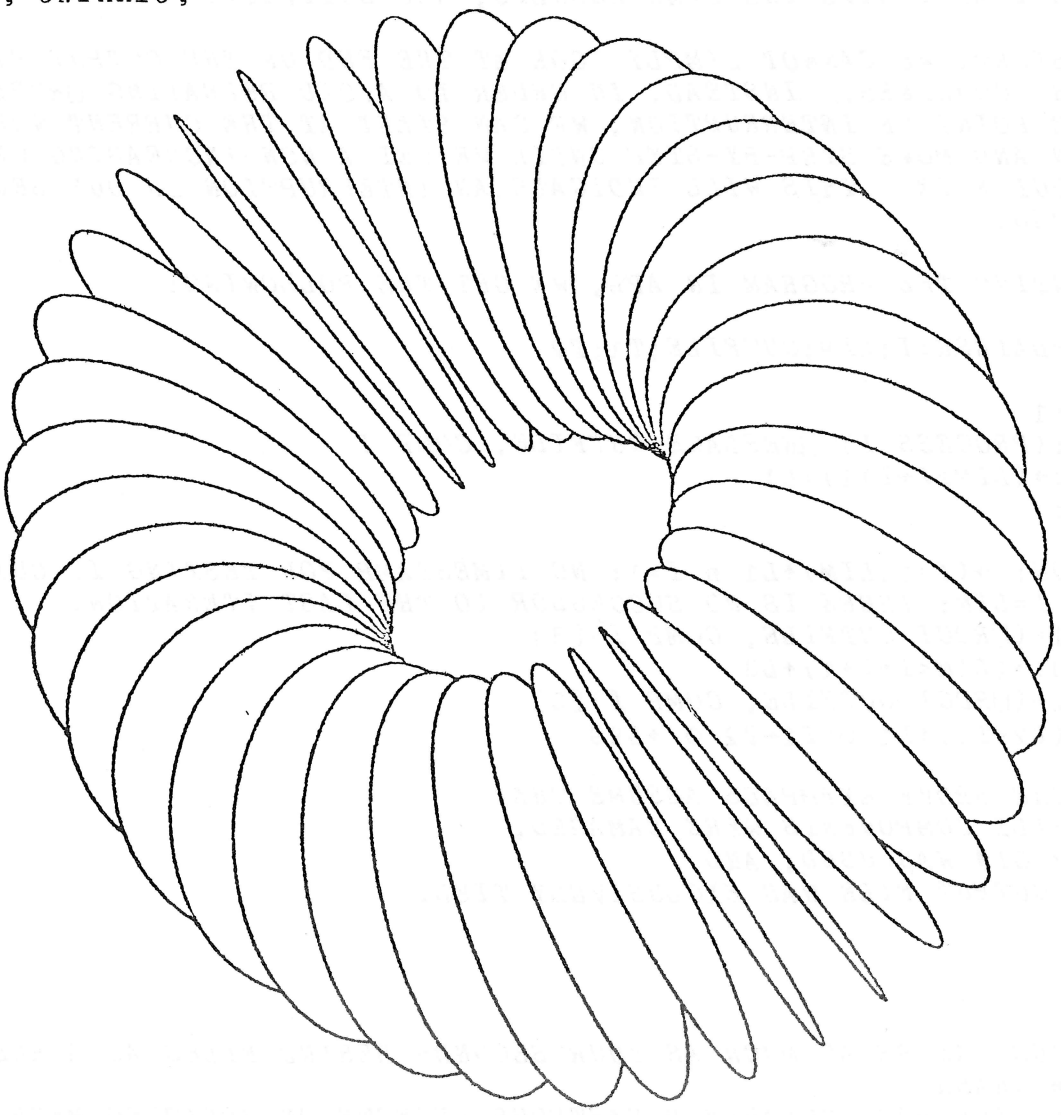
SUMMARY

WORKSPACES CAN BE AS MUCH AS FOUR SECONDS BEHIND FILES AS A RESULT OF A SYSTEM CRASH.
THIS CAN HAVE PARTICULARLY DISASTROUS EFFECTS ON UPDATING MECHANISMS.
TWO METHODS OF RESOLVING INTERRUPTIONS ARE:
1) TO RESTART UPDATING FROM THE BEGINNING (IF THIS IS POSSIBLE), OR
2) TO INCORPORATE, IN ADDITION TO THE RESTART MECHANISM, SOME 'SYNCHRONIZATION' LOGIC.

TEMPUS FUGIT FOR THE TEMPIS FUGIT CONTEST!

THE DEADLINE FOR SUBMISSIONS IS DECEMBER 31. ENTRIES WILL BE JUDGED FIRST FOR COMPLETENESS, THEN ELEGANCE, AND FINALLY [ONLY IF NECESSARY] ON SPEED.

A PRIZE WILL BE GIVEN FOR THE BEST OVER-ALL ENTRY. IF THE WINNER TURNS OUT TO BE AN IPSA-ENTRY, ANOTHER WILL BE AWARDED FOR THE BEST CUSTOMER ENTRY.

MAIL/BOX ALL ENTRIES TO:

HAL CARIM [MAILBOX CODE: HCA]
I.P. SHARP ASSOCIATES,
145 KING STREET WEST,
SUITE 1400,
TORONTO, ONTARIO,
M5H 1J8
CANADA